

**CALIFORNIA BIRD SPECIES  
OF SPECIAL CONCERN 2002**

**A RANKED ASSESSMENT OF SPECIES, SUBSPECIES, AND  
DISTINCT POPULATIONS OF BIRDS OF IMMEDIATE  
CONSERVATION CONCERN IN CALIFORNIA**

**DRAFT REPORT TO  
CALIFORNIA DEPARTMENT OF FISH AND GAME**

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## CONTENTS

Abstract.....	1
Introduction.....	3
Methods.....	4
Nominations for the BSSC List.....	8
Criteria and Ranking Scheme.....	9
Definition of a Bird Species of Special Concern.....	10
Ranking Criteria.....	10
Scoring of Taxa.....	15
Ranking Scheme.....	16
Analyses.....	18
Responsibility List.....	19
Taxa to Watch.....	20
Species Accounts.....	20
Criteria Scores.....	20
Special Concern Priority.....	20
BBS Statistics for California.....	21
General Range and Abundance.....	21
Seasonal Status in California.....	22
Historical Range and Abundance in California.....	22
Recent Range and Abundance in California.....	22
Ecological Requirements.....	22
Threats.....	23
Management and Research Recommendations.....	23
Monitoring Needs.....	23

Range Maps.....	24
Results.....	25
Bird Species of Special Concern in California.....	25
Linear Versus Categorical Ranking Schemes.....	25
Correlation Among Scores.....	26
Comparison with Prior Lists.....	26
Occurrence by Habitat.....	28
Geographic Distribution.....	28
Monitoring and Rangewide Surveys.....	30
Responsibility List of Birds in California.....	30
Taxa to Watch.....	31
Discussion.....	31
Units of Conservation.....	31
Peripheral Populations.....	32
Elusiveness of Perfect Ranking Approach.....	33
Habitat and Geographic Patterns.....	35
Threats.....	36
Prioritization.....	36
Identifying Positive Trends.....	38
Research and Monitoring.....	38
Using the List to Foster Conservation.....	39
Recommendations.....	41
Literature Cited.....	44
Tables and Appendices.....	54

## **ABSTRACT**

To prevent further population declines of native birds, California Department of Fish and Game (CDFG) initiated a process to set conservation and research priorities by revising the initial California Bird Species of Special Concern document (Remsen 1978), which subjectively described declining or vulnerable species. Revision was needed to identify currently at-risk taxa that may warrant listing as state threatened or endangered if proactive actions are not taken. Working with an advisory committee of leading California ornithologists, we considered 289 bird taxa as nominees for the special concern list using published data, expert opinion, public input, and national and regional lists of priority or focal species for major conservation initiatives. Nominated taxa were scored for seven objective criteria: population size, range size, population trend, range trend, population concentration, percent of population within California, and threats. The bird species of special concern list was then prepared by culling taxa and assigning those remaining to three levels of priority using both linear and categorical ranking schemes. This ranking process is dynamic, as it allows for scores to be updated as new data become available. The prioritized list consists of 42 species and 26 subspecies or geographic populations. Although unranked, an additional 11 taxa also qualified either because they have been extirpated from the state or are listed as federally, but not state, threatened or endangered. We also developed a Responsibility List of Birds in California, intended as a tool for longer-term conservation planning, consisting of 119 taxa that qualified because all or a very high proportion of their global populations occur in the state. A taxon's co-occurrence on both the special concern and responsibility lists indicates a particularly high level of conservation concern in California. Priority should

also be raised for special concern taxa identified as globally vulnerable and for restoration, research, and monitoring projects that are habitat based and benefit multiple species.

Species accounts document the numerical scores for the seven ranking criteria and describe the status, population trends, ecological requirements, threats, and management, research, and monitoring needs for each special concern taxon. Habitats with high numbers of special concern taxa are wetlands, grasslands, riparian forests and woodlands, and scrublands – habitats with the highest rates of loss in California. Paralleling continental and worldwide trends, habitat loss and degradation is the greatest threat to California's at-risk birds. Geographic areas with the highest numbers of special concern taxa are southern and central coastal California, where pressures from high and expanding human populations are expected to intensify in coming decades. Currently most special concern taxa are poorly monitored. Conservation and research efforts should focus on the identification of factors responsible for population declines and adaptive management actions, habitat acquisition, and stewardship that will reverse these declines. The special concern list, if used synergistically with laws, regulations, state policies, and various state or national conservation initiatives, will form an important part of CDFG's toolbox to protect, aid in recovery, and forestall listing actions for the state's at-risk birds.

Recommendations for future improvement of the process include frequent review and update of the list, an online database to track new information, refinement of monitoring protocols and research needs, education of stakeholders of the need to protect

at-risk birds, and coordination of volunteer monitoring efforts and conservation actions with other multi-species conservation initiatives.

## **INTRODUCTION**

In 1978, California Department of Fish and Game (CDFG) published an annotated list of Birds Species of Special Concern (BSSC). This list summarized the status and range, causes of decline, potential threats, and management needs for 61 taxa (59 species, 2 subspecies) of California birds that had experienced severe population declines or were otherwise vulnerable to future extinction within the state (Remsen 1978). Species were subjectively placed on the list and assigned to three categories based on the perceived urgency of concern for their populations. Although inclusion on the special concern list did not confer any special legal status, categorization of species was intended to provide guidance in setting priorities for expenditure of research funds, acquisition of habitat, and other management actions. In subsequent years, taxa were periodically added to, or removed from, the list, but no formal review was made of the state's at-risk birds. The last update of the bird species of special concern list in 1992, containing 73 bird taxa (60 species, 13 subspecies), was also subjective, not annotated, and did not categorize taxa by their level of concern (CDFG 1992).

Californian's must overcome daunting problems to maintain the state's superlative biodiversity in the face of severe and ongoing habitat loss and degradation, which has led to population declines of many native species. To meet this challenge, in 1998 CDFG initiated a process to set conservation, research, management, and funding



priorities for native birds by forming a Bird Species of Special Concern Technical Advisory Committee composed of some of California's top field ornithologists, taxonomists, resource agency managers, and conservationists. The charge of the advisory committee was to guide CDFG in revising the original special concern document (Remsen 1978) by developing a scientifically defensible and repeatable method to set objective standards for inclusion of birds on the list and for assigning them to different levels of conservation priority. Revision was needed to incorporate over twenty years of research and monitoring data to enable identification of currently declining or vulnerable birds that may warrant listing as state threatened or endangered if present trends continue. As a regulatory tool, the special concern list is intended to guide state, federal, and local governments in defining "sensitive" species under the California Environmental Quality Act (CEQA) to enable conservation measures to forestall listing actions. The special concern list is also meant to stimulate further research on the status, distribution, ecology, and systematics of California's at-risk birds to better aid in their conservation.

The revision of the bird species of special concern list coincided with a period of rapidly increasing concern for global-to-local loss of biological diversity (e.g., Sisk et al. 1994, Poiani et al. 2000) and with the blossoming of objective schemes to prioritize needed conservation efforts (e.g., Millsap et al. 1990; IUCN 1994, 2001; Carter et al. 2000; Brown et al. 2001; NAWCPSC 2001). The present document joins CDFG's recent special concern reports for amphibians and reptiles (Jennings and Hayes 1994), fishes (Moyle et al. 1995), and mammals (a revision of Williams 1986 is currently under review).

Here we present California's list of Bird Species of Special Concern 2002 and describe the criteria and ranking scheme used to cull a large list of nominees and assign the remaining at-risk species, subspecies, and distinct populations to three levels of conservation priority. We describe patterns of distribution of bird species of concern across habitats and geographic regions of California, rank the relative importance of various threats to all at-risk taxa, and evaluate the adequacy of current monitoring programs for these birds. We also make recommendations for ongoing evaluation of at-risk birds and broad management and research objectives needed to enable effective conservation. These analyses and recommendations are derived in part from individually authored species accounts. These accounts form the backbone of the document by describing the status, population trends, ecological requirements, threats, and management, research, and monitoring needs for each taxon. Finally, and most importantly, we make recommendations for how the special concern list can be used synergistically with laws, regulations, state policies, and various state or national conservation initiatives to protect and aid in recovery of the state's at-risk birds.

## **METHODS**

Developing a framework for conservation of biodiversity necessarily involves identification of the units, scale, and context involved. Systems for identifying birds warranting conservation concern, though, do not always explicitly discuss these topics. A lack of expression of underlying assumptions can lead to confusion in the application of such schemes. To avoid this pitfall, we describe here our ranking scheme's underlying assumptions, which were developed via extensive discussions of other conservation ranking systems by the advisory committee and given a broader context by evaluation of

additional conservation literature. As our scheme was developed by a collaborative process among the advisory committee, the authors, and CDFG, for convenience the collective “we” is often used when attributing the source of the ideas and methods employed.

We conservatively defined our units of conservation as species, subspecies, and distinct populations, the basic approach of the U.S. Endangered Species Act (USDI and USDC 1996, Pennock and Dimmick 1997). This implies a desire to protect species and the genetic diversity within them. For convenience, throughout the text we refer to species, subspecies, and distinct populations collectively as “taxa” (taxon for singular), though technically “distinct populations” are not taxonomic units as are species and subspecies. We followed the biological species concept for species, which is adopted by the American Ornithologists’ Union (1998). We followed that source and its supplements for scientific names of species (see below for subspecies). Scientific names for all species and subspecies of birds are listed in the tables, except in a few cases when mention is made in the text of subspecies determinations that are not widely accepted.

Increasing advances in molecular genetics have led to considerable debate as to what constitutes a “distinct population segment” and a genetically defined “evolutionarily significant unit” (see overview by DeWeerd 2002). Recognizing that traditional phenotypic and recent genetic assessments can lead to different conclusions about the distinctness of subspecies and populations (e.g., Zink et al. 2000), we still took the pragmatic approach that for most birds phenotypic subspecies are the most applicable unit of conservation below the species level. This approach is based on both the assumption that phenotypic subspecies are likely to represent ecological adaptations, and

that genetic studies as yet have limited applicability to birds given they have been conducted on relatively few polytypic species in California. Although there has not been a review of subspecific taxonomy in North America or California since that of the AOU (1957), we decided to use that reference as modified by subsequent published sources as the basis for subspecific determinations and their scientific names. This recognizes, though, that future evaluation of the diagnosability of subspecies is likely to reduce the number of trinomials (Patten and Unitt 2002). We restricted the use of distinct populations to ones that appear to be well isolated geographically (and likely genetically) from other large populations of the same species, such as coastal versus interior populations of the snowy plover. The common names for subspecies used here generally follow those in Grinnell and Miller (1944), subsequent published literature, or those otherwise widely used. When an established common name for a subspecies was lacking, preference was given to one describing the region of geographic occurrence of the taxon or, secondarily, to a patronym mirroring the scientific name.

Given the context was the conservation of the biodiversity of California's avifauna, we rejected the evaluation of biological factors expressed at the global or continental level. Hence, we did not score taxa on the magnitude of their global or U.S. populations, ranges, or threats as do some other schemes (Carter et al. 2000, Brown et al. 2001). This does not, of course, preclude additional prioritization on the basis of such factors, as discussed later. We did, however, decide to score taxa on a scale from endemic to wide-ranging on the assumption that, all else being equal, priority should be given to taxa with a high proportion of their North American population or range within the state. We realized that our California-centrism might lead to inclusion on the special

concern list of a relatively high proportion of birds reaching the edge of their range in California and that such an approach has virtues and shortcomings (Hunter and Hutchinson 1994, Peterson 2001). Still, we wanted to emphasize the retention of the state's biodiversity and hence the conservation of all well-established bird populations. Although it can be difficult to define whether a taxon is "well-established," we tried to restrict this to exclude birds occurring as rare migrants, winter visitors, or breeders far from their core range or as part of very small populations on the fringe of their range that likely are maintained by recruitment from populations outside of California (e.g., laughing gull, northern cardinal). We also restricted consideration of most threats to birds that are beyond the ability of agencies and biologists to effectively offset by management at the state level. Hence, though we recognize that global climate change may have profound effects on the earth's ecosystems and bird populations (Moss 1998, McCarty 2001), it seemed best to focus on threats that have caused population declines and range retractions in the state that potentially can be reversed by management actions there. This line of reasoning led to emphasis in the ranking scheme on population declines, range retractions, and immediate threats and, secondarily, factors that increase birds' vulnerability to decline or extinction (small population or range size, population concentration).

Within this context, we defined a bird species of special concern, selected a pool of potential nominees to the special concern list, identified objective criteria to score nominated taxa, and developed a ranking scheme to discriminate taxa warranting inclusion on the list and their level of conservation priority within the list.

## **NOMINATIONS FOR THE BSSC LIST**

During the development of the criteria and ranking scheme described below, the advisory committee cast a wide net to ensure a robust list of taxa to evaluate for possible inclusion on the revised birds of special concern list. The initial set of nominees included all bird taxa on prior special concern lists (Remsen 1978, CDFG 1992), all candidates to the original list (Remsen 1978), those birds among the “Special Animals” tracked by the California Natural Diversity Database (<http://www.dfg.ca.gov/whdab/html/animals.html>), species or subspecies recently considered candidates for listing as federally threatened or endangered (USFWS 1989), all federally threatened or endangered taxa (and populations), taxa nominated by contributors, species showing significant California declines on the Breeding Bird Survey (BBS; Sauer et al. 2001), and species or subspecies endemic to California. Excluded from consideration for the special concern list were taxa currently listed as state threatened or endangered by the California Fish and Game Commission because their listed status gives them higher (legal) protection. Also excluded were non-native species introduced to California, as there is no evidence that they should be of conservation concern in California (see Patten and Erickson 2001).

Later, Point Reyes Bird Observatory biologists (the authors and Grant Ballard) added as nominees species that had high rankings for conservation concern in any of the five Bird Conservation Regions (BCRs) that overlap with California. As defined by the North American Bird Conservation Initiative (NABCI), BCRs are ecological units that provide a consistent spatial framework for bird conservation across North America (<http://www.bsc-eoc.org/international/bcrmain.html>). The BCRs that overlap with California are: BCR 5 = Northern Pacific Rainforest, BCR 9 = Great Basin, BCR 15 =

Sierra Nevada, BCR 32 = Coastal California, and BCR 33 = Sonoran and Mohave Deserts (<http://www.manomet.org/USSCP/bcrlocator.htm>; Figure 1). We considered species as having high rankings if for any California BCR they qualified for “Priority Pool Tiers” I or II of the National Partners in Flight (PIF) Rankings (Panjabi 2001; scores available at <http://www.rmbo.org/pif/pifdb.html>) or had Area Importance (AI) scores of 4 or 5 in the National Shorebird Conservation Assessment of the U.S. Shorebird Conservation Plan (Morrison et al. 2000). Nominees continued to be added in response to queries from knowledgeable biologists, particularly after a draft list, prepared by the process described below, was posted on the internet for review (CDFG and PRBO 2001). Ultimately, 289 taxa were nominated, scored for seven criteria, and ranked for conservation concern as described below.

#### **CRITERIA AND RANKING SCHEME**

As a means to identify birds that qualify for the special concern list and to set levels of conservation priority within the list, the advisory committee debated at length the merits of various ranking schemes and the biological ranking criteria within them (see Ahern et al. 1985, Millsap et al. 1990, Reed 1992, IUCN 1994, Beissinger et al. 2000, Carter et al. 2000). Discussions led to the drafting of a definition of Bird Species of Special Concern in California, development of objective criteria used to score nominated taxa, and a method to use the scores to discriminate taxa qualifying for the list and to assign them to three levels of conservation priority.

## Definition of BSSC

To ensure the ranking criteria and scheme would be consistent with the concept of a species of special concern, we defined *Bird Species of Special Concern in California* as:

Those species, subspecies, or distinct populations of native birds that currently satisfy one or more of the following criteria:

- meet the state definition of threatened or endangered but have not formally been listed.
- are extirpated from the state totally or in their primary seasonal or breeding role and were never listed as state threatened or endangered.
- are listed as federally, but not state, threatened or endangered.
- are experiencing, or formerly experienced, serious population declines or range retractions that if continued, or resumed, could qualify them for state threatened or endangered status.
- have naturally small populations exhibiting high susceptibility to risk from any factor(s) that if realized could lead to declines that would qualify them for state threatened or endangered status.

## Ranking Criteria

The advisory committee decided on seven objective criteria to use in scoring and ranking a set of nominee taxa: population trend, range trend, population size, range size, population concentration, percentage of entire range within California (endemism), and vulnerability to threats. Each nominated taxon was scored for all criteria as described below. For the population and range trend criteria (and corresponding sections in species



accounts), we used Grinnell and Miller (1944) for separating the *historical* and *recent* periods and thus for gauging trends in these criteria for the latter period. This reference provides a convenient benchmark given it is the primary source summarizing the status and distribution of California's birds through the middle of the 20<sup>th</sup> century. So as not to prejudge all taxa restricted to marine or coastal habitats *a priori* as having small ranges in California, we set different baselines for marine (or coastal) and upland (or interior wetland) taxa against which to gauge the percent of California they occupied.

Descriptions of the seven criteria are:

*Population Trend (PT)*

This criterion estimates the change in a taxon's population size from the time of the publication of Grinnell and Miller (1944) to the present. Scores are based on quantitative or anecdotal data on the magnitude of population change or, if lacking, data on changes in the availability or condition of a taxon's habitat. Taxa were given a 0 for population trend, even if the California population is declining, if the overall population is stable or increasing and the decline in California results from a geographic shift in the range that was *not* caused by habitat loss or degradation or other threats in California.

Population size:	Score
seriously (>80%) reduced	20
greatly (>40-80%) reduced	15
moderately (>20-40%) reduced	10
slightly (>10-20%) reduced or suspected of having been reduced but trend unknown	5
stable (<10% reduced) or increasing	0

*Range Trend (RT)*

The range trend criterion estimates the change in the size of a taxon's breeding or wintering range in California from the time of publication of Grinnell and Miller (1944) to the present. Scores are based on gross changes to a taxon's range polygon (i.e., the outlying boundary of the range). When more thorough data are lacking, range trend can be inferred by loss of habitat. The trend does *not* estimate the extent of local extirpations within the overall range. Taxa were given a 0 for range trend, even if the California population is declining, if the overall population is stable or increasing and the reduction in the California range results from a geographic shift in the range that was *not* caused by habitat loss or degradation or other threats in California.

## Range size:

seriously (>80%) reduced	20
greatly (>40-80%) reduced	15
moderately (>20-40%) reduced	10
slightly (>10-20%) reduced or suspected of having been reduced but trend unknown	5
size stable (<10% reduced) or increasing	0

*Population Size (PS)*

This criterion estimates the number of individuals of a taxon in California during the season of concern (breeding, wintering or otherwise).

## Population size:

<1000 individuals	10
≥1000 but <10,000 individuals	7.5

$\geq 10,000$ but $< 100,000$ individuals	5
$\geq 100,000$ but $< 1,000,000$ individuals	2.5
$> 1,000,000$ individuals	0

*Range Size (RS)*

The range size criterion estimates the percentage of California occupied by a taxon, measured by the range polygon's outlying boundary. Seabirds or other waterbirds restricted solely to coastal estuarine, inshore, or pelagic waters are evaluated based on the marine environment from the California coastline west 200 miles (American Birding Association Checklist Area; ABA 1996). All other species are evaluated based on terrestrial California, i.e., the political boundary of the state exclusive of ocean waters.

Range size (% of California occupied):

$\leq 10\%$	10
$> 10\% - 50\%$	5
$> 50\%$	0

*Percentage of Entire Range within California (EN)*

This criterion measures what proportion of a taxon's North American range or population occurs within California. Taxa with a high proportion of their range or population within California are considered of greater concern than taxa with only a small proportion of their range or population in the state.

Proportion of North American range and/or population within California:

100% (endemic)	10
$> 80\%$ but $< 100\%$ (near-endemic)	7.5
$> 50\% - 80\%$	5

>20%-50%	2.5
<20%	0

### *Population Concentration (PC)*

This criterion estimates how concentrated a taxon currently is within its California range during critical life stages (e.g., breeding, migration). Highly concentrated taxa generally are considered more vulnerable to predation, disease, or other catastrophic events than are widely dispersed taxa. The criterion should be used with caution for taxa that are not colonial breeders, restricted to true islands or habitat islands, or concentrated at isolated water bodies.

Majority (>50%) of population concentrated at:

1-3 sites.	10
4-30 sites.	5
>30 sites.	0

### *Vulnerability to Threats (THR)*

This criterion estimates the approximate impact of realized known threats and (secondarily) potential irregularly occurring catastrophic events (e.g., oil spills, disease events) known to periodically affect some taxa. Scores are based on projected long-term realized impacts of single or multiple threat factors and not on speculative threats for which there is no historical basis.

In the next 20 years, habitat loss, habitat degradation, or other human-induced threats are projected to:

seriously reduce (>20%) a taxon's population in California	20
greatly reduce (>15-20%) a taxon's population in California	15

moderately reduce (>10-15%) a taxon's population in California	10
slightly reduce (>5-10%) a taxon's population in California	5
have no substantial net impact, i.e., a taxon's population should remain stable (<5% reduced) or increase in the next 20 years	0

### **Scoring of Taxa**

After the development of an initial list of nominee taxa, as described above, one or more biologists then scored each of these taxa (species, subspecies, or distinct population) on a scale of 0-10 for each of the seven criteria. Tim Manolis and Michael Patten performed most of the initial scoring; Tom Gardali took over the task at the point we began assessing taxa with high rankings for California BCRs. For each taxon, biologists scored just the population in the season for which the taxon is of concern in California. For example, scores for the Northern Harrier apply only to the state's breeding population, since it is much more numerous and of much less concern in the state in winter. After considering various alternatives, we ultimately weighted (doubled) the population trend, range trend, and threats scores to reflect the emphasis on population declines, range retractions, and threats in the definition of a bird species of concern. The scoring biologists based scores on the best available information, including published papers, unpublished reports, BBS trend data, Christmas Bird Count (CBC) data, published and unpublished breeding bird atlas data, egg set or specimen data, unpublished field notes, and professional opinion. Many scores are approximations, though, given the frequent lack of precise data. Once complete, the list of scores for all nominees was circulated to all members of the advisory committee for review. Not all members reviewed all scores, and hence, with few exceptions, preliminary scores

represented the research or opinion of the initial scoring biologist. To further refine scores, we modified them for some taxa on the basis of outside reviewers' requests for reevaluation, suggestions for specific score changes, or assessment by the authors of species accounts (see below). Scores for all nominated taxa are currently maintained on the PRBO website at <http://www.prbo.org/BSSC/index.htm>.

In the future, a taxon may be re-evaluated for inclusion on, or removal from, the special concern list on the basis of a request for specific changes to criteria scores submitted by an advisory committee member or other expert. Requests for score changes must be accompanied by substantive but brief written documentation of the reasons for the requested change. All requests for score changes will be evaluated and either accepted or rejected by a vote of the advisory committee.

### **Ranking Scheme**

We used two methods – one *linear*, the other *categorical* – to identify taxa for inclusion on the special concern list as a whole and within three levels of conservation priority. We used two methods because of substantial controversy in the literature regarding the merits and shortcomings of these alternative approaches (e.g., Beissinger et al. 2000, Carter et al. 2000) and our belief that different methods might identify birds of conservation concern for different but complementary reasons.

The *linear* scheme sums scores for all seven criteria and ranks the nominee list by total score (higher scores indicating greater concern). For the linear scheme, we assigned three levels of priority by identifying natural breaks in the list of total scores. The *categorical* scheme identified taxa both for inclusion on the list and within three levels of priority based solely on one or a few criteria scores. We combined the results of the

linear and categorical approaches, as described below, to obtain a final bird species of special concern list.

Regardless if scored or not, some additional taxa were added to the list solely on the basis of matching one of the criteria in the definition of a species of concern. These included (1) taxa extirpated as breeders in California and (2) taxa listed as federally, but not state, threatened or endangered. These are listed in Table 1 in corresponding categories of special concern, but no species accounts were written for them.

*Linear scheme.* The version described here is actually a *weighted* linear ranking scheme in that the population trend, range trend, and threat scores are doubled relative to other criteria to emphasize the importance of declines over vulnerability. Regardless, the scores for all criteria for each taxon are summed and arranged from highest to lowest. After inspection of the initial list of scored taxa, we drew an arbitrary line thereby including on the linear ranked list all taxa with summed scores  $\geq 37.5$ . We further used natural breaks in the data for all taxa to divide the linear list into three levels of priority: First Priority: Scores  $\geq 60$  and  $\leq 90$ , Second Priority: Scores  $\geq 47.5$  and  $< 60$ , and Third Priority: Scores  $\geq 37.5$  and  $< 47.5$ .

*Categorical scheme.* Like the linear scheme, the categorical scheme outlined here emphasizes scores for population trend, range trend, and threats. Instead of adding all scores for all criteria, however, the categorical approach uses one or several scores to simultaneously develop the list and discriminate between three levels of priority. The criteria scores needed for inclusion in each of three (arbitrarily defined) priority levels and their verbal equivalents are:

First Priority: PT or RT = 20 OR THR = 20 and PT or RT = 15. Population or range size seriously reduced OR population or range size greatly reduced and threats projected to seriously reduce the taxon's population in California in the next 20 years.

Second Priority: PT or RT = 15 OR THR = 15 and PT or RT = 10. Population or range size greatly reduced OR population or range size moderately reduced and threats projected to greatly reduce the taxon's population in California in the next 20 years.

Third Priority: PT or RT = 10 and PS, RS, or PC  $\geq 7.5$  OR THR = 15 and PS, RS, or PC  $\geq 7.5$ . Population or range size moderately reduced and population is at high risk because of at least one vulnerability factor OR threats projected to greatly reduce a taxon's population in California in the next 20 years and the taxon's population is at high risk because of at least one vulnerability factor.

*Combining methods for the official list.* We consolidated qualifying taxa into two sections on the official list of bird species of special concern. The first included the taxa qualifying solely on the basis of the definition of a species of concern. The second included those qualifying on the basis of the final ranking scheme, which merged the linear and categorically ranked lists. We merged taxa on the linear and categorical lists by assigning each to one of three levels of priority using the higher of the two priority scores from the two lists (Appendix 1). For example, if a taxon had a priority level score of 2 on the linear list and a 3 on the categorical list we assigned it a 2 on the official (final) list. If a taxon was on one list and not on the other we assigned it a final priority by the single priority score originally assigned. For example, if a taxon scored a 2 on the linear list but was not on the categorical list (or vice versa) its priority level score on the final list was also 2. As with criteria scores, we adjusted the draft list and priority



rankings on the basis of research by species account authors or external review. We solicited review of the list by sending copies directly to selected knowledgeable individuals and, more widely, by posting it on the PRBO website ([www.prbo.org](http://www.prbo.org)) from May 2001 until the final draft of this documents was completed.

## **ANALYSES**

Because scores among various criteria may be highly correlated, and therefore not independent (Beissinger et al. 2000), the validity of a ranking system that simply adds such scores together may be questioned. To address this concern, we looked for correlations among criteria scores for nominated taxa using the Spearman Rank Correlation test in the program STATA version 7.0 (Stata Corp. 1999). We also used this test to compare the concordance of the linear and categorical schemes in assigning taxa to three levels of conservation priority. Finally, we made descriptive analyses of the patterns of distribution of bird species of concern across habitats and geographic regions of California, of the relative importance of various threats to all at-risk taxa, and of the adequacy of current monitoring programs for these birds. Analyses of geographic patterns were made on the basis of the BCR ecological units (<http://www.manomet.org/USSCP/bcrlocator.htm>) and the Jepson geographic subdivisions of California (Hickman 1993; Figures 1 and 2). Following the categories used by Wilcove et al. (1998, 2000), we classified threats to special concern taxa as either habitat loss or degradation, alien species (competition with or predation by), pollution (contaminants, siltation), overexploitation, or disease. For all analyses, we recognize that there are important limitations to the biological data available and that there is uncertainty as to how these limitations affect our results.

## **RESPONSIBILITY LIST**

Dunn et al. (1999) used responsibility scores to indicate a high degree of stewardship responsibility for the conservation of landbirds in Canada. In that vein, we developed a *Bird Responsibility List for California* to highlight taxa for which the state should bear stewardship responsibility for conservation. We set the standard for inclusion on the list as those taxa having scores of 10 or 7.5 for the EN criterion (i.e., all endemic or “near-endemic” taxa), regardless of their current level of conservation concern.

## **TAXA TO WATCH**

We also identified taxa for inclusion on a list of “taxa to watch” on the basis of prior concern for the well being of their populations in California. We defined “taxa to watch” as those that are not on the 2002 special concern list that (1) formerly were on the 1978 (Remsen 1978) or 1992 (CDFG 1992) special concern lists and are not currently listed as state threatened and endangered, (2) have been removed (delisted) from either the state or federal threatened and endangered lists, or (3) that are currently designated as “fully protected” in California (<http://www.dfg.ca.gov/hcpb/species/species.shtml>).

## **SPECIES ACCOUNTS**

Individual authors wrote species accounts that describe the status, population trends, ecological requirements, threats, and the management, research, and monitoring needs for each taxon on the ranked list of bird species of special concern. These accounts provide scientific documentation for the criteria scores. This information justifies each taxon’s inclusion and priority ranking within the special concern list and the biological underpinnings for recommendations to those responsible for making decisions that affect

the conservation of these birds. All accounts concisely summarize current knowledge and information gaps for special concern birds in a standard format with 11 sections:

### **Criteria Scores**

This is a one-row table of the seven criteria scores for each taxon.

### **Special Concern Priority**

This section describes the current level of special concern (conservation) priority and the season of concern (e.g., breeding, winter, year round). If applicable, it also describes the priority in the original list (Remsen 1978) and whether the taxon was included on the most recent unprioritized list (CDFG 1992).

### **Breeding Bird Survey Statistics for California**

This section presents a summary table of the most recent BBS data for the taxon when data for California are suitable for trend analysis (Sauer et al. 2001). Descriptions of the BBS trend, or lack thereof, are included in the text of the section on “Recent Range and Abundance in California,” according to the following standards and terminology. Statistical significance is defined as any trend with a  $P$  value of  $\leq 0.10$ . Levels of significance (or near significance) are described verbally in the text (on the basis of the table’s  $P$  values) as *approaching significance* ( $P = 0.12 - 0.19$ ), *marginally significant* ( $P = 0.1 - 0.06$ ), *significant* ( $P = 0.05 - 0.01$ ), and *highly significant* ( $P < 0.01$ ). Trend data are reported only if they meet the data credibility rankings of *high* (blue) or *medium* (yellow) as defined by Sauer et al. (2001). High credibility reflects data with at least 14 samples, of moderate precision, and of moderate abundance on survey routes; medium credibility reflects data with a deficiency. Low (red) reflects data with an important deficiency, thus indicating that a taxon is not well sampled by the BBS in California.

### **General Range and Abundance**

This section briefly and broadly describes the taxon's North American and, if applicable, global range and distribution, thereby justifying the endemism score. As applicable, it distinguishes among patterns of distribution for breeding, migration, and winter and for summering non-breeders outside the breeding range; it does *not* describe patterns of extralimital occurrence. Any subspecies involved are mentioned, including those no longer considered valid or for which there are conflicting taxonomic treatments.

### **Seasonal Status in California**

This section briefly describes the *primary* seasonal status and period of occurrence of the taxon in California. For nesting species, the period of the *breeding season* is defined as the time from the laying of the first eggs through the fledgling of the last young.

### **Historical Range and Abundance in California**

The *historical* (vs. *recent*) period was defined as being up to, and including, the publication of Grinnell and Miller (1944). This section describes the abundance and distribution of a taxon in California prior to 1945, thereby establishing a baseline against which population trend, range trend, and, to a lesser degree, threats can be judged. It also describes features not easily mapped, such as any geographic or subspecific variation in status (e.g., clinal variation in abundance), particular dispersion patterns (e.g., patchy, clumped, etc.), or other distinctive patterns of distribution and abundance.

### **Recent Range and Abundance in California**

This section describes the distribution and abundance of a taxon in California from 1945 to the present. Comparisons to the historical period to describe population and

range trends serve to justify the criteria scores for population and range size and trend.

The text on the current range complements the accompanying range map (see below) by describing the range relative to county boundaries, geographic areas (e.g., Sacramento Valley), or physiographic regions (e.g., Mohave and Colorado deserts). Like the previous section, this one describes patterns of geographic variation in status.

### **Ecological Requirements**

This section discusses the habitat requirements of the taxon in California, focusing on details of ecological factors that may limit the taxon or features relevant to managers. As applicable, it describes or summarizes seral stage, dominant plants, and habitat structure of habitats occupied; geographic or seasonal variation in habitat use; key habitat features (e.g., snags, cavities, canopy layers); noteworthy adaptations; known population limiting factors; seasonal habitat use in terms of latitudinal and altitudinal range, climatic limits, and topography; and important components of food, cover, and nesting substrate.

### **Threats**

This section describes the type and severity of threats known or highly suspected of causing population-level effects on a taxon in California; applicable threats elsewhere are described only when little information is available on these threats in California. Potential threats are clearly labeled as such. When possible, authors express judgments of the capability of current and future threats to reduce the population or range size or to alter distribution patterns or habitat use of the taxon in California.

## **Management and Research Recommendations**

This section consists of a bulleted list of recommendations for effective management measures to stem or reverse population declines or range retractions or minimize population threats and for research needed to better guide management and restoration efforts.

## **Monitoring Needs**

This section assesses the adequacy of current statewide monitoring strategies (e.g., BBS, Monitoring Avian Productivity and Survivorship [MAPS] program, CBC) to detect changes in the population trend of each taxon. Although it is beyond the scope of this report to make detailed recommendations on specific monitoring protocols for each taxon, account authors do suggest ways of improving current monitoring methods or implementing new ones. In the process, they address the need for standardized protocols and the appropriate frequency of monitoring.

## **Range Maps**

The range maps that accompany each species account were prepared by the following process (see Hollander et al. 1994). CDFG first plotted distribution data from various sources (BBS, CBC, California Natural Diversity Database, National Parks Occurrence Data, other CDFG data) on base range maps of full species initially developed in the mid-1980s as part of their California Wildlife Habitat Relationships (CWHR) system. Next CDFG annotated these base maps with distribution information from key publications and reports. They then provided account authors with copies of the annotated CWHR species map printed on semi-transparent velum, a base map of California, and a map of Ecological Units of California (Goudy and Smith 1994), all at a

scale of 1:1,000,000. Authors drew any needed changes on the annotated CWHR map, which they overlaid on the other maps to identify physical and ecologic range boundaries when applicable. To ensure map accuracy, account authors used all readily available information to verify the extent of the range of each taxon. Only in a few cases, though, were authors able to obtain pertinent specimen and egg set data from all major California museums; when they did, it usually was via their prior research on the taxon in question. After revision by the authors, maps were reviewed by the advisory committee's map editors (John Sterling and Dick Erickson), returned (as needed) to authors, and then forwarded to CDFG for final digitizing. For subspecies, account authors drew the initial range maps from scratch; otherwise the process for subspecies followed that for species.